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(speculative) assume of a "depression memory"
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Psychotherapy for depression under the (speculative) assume of a "depression memory" due to a structural change in the neurobiological reward system

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2019

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Abstract

Based on an integrative cognitive-behavioral and biological approach, depression results from failed attempts to appropriately cope with the negative feelings that result from stressful situations. In a longer-lasting, emotionally harmful situation, quick strong but not long-term effective **avoiding-coping strategies** are used to relieve the negative emotional state. One such coping strategy entails the **avoidance of movement and action activities** (passivity in behavior), which constitute the later **behavioral symptoms of depression**. Scientific investigations have shown that it is not only drugs but also (rewarding) behaviors that are capable (by means of positive reinforcement and negative reinforcement) of causing **profound structural physiological changes in the reward system**. It is assumed that avoidance-based coping strategies provide **strong and immediate emotional relief** (reward). This increases the likelihood of reusing the respective coping strategy; further, the positive effect (i.e., emotional relief) is short-lived, and the stressor is not eliminated. As a result of the frequent and conditioned use of avoidance-based coping strategies, the structures of the reward center change and a “depression memory” develops. In certain stimulus constellations (including stimulus generalization), **learned “relief strategies,” which serve as the depressive behavioral patterns** (behavioral inactivity), are **predominantly** triggered automatically. A clearly formulated behavioral intention does not have to exist. The result of depression memory is that the **behavioral symptoms of depression now dominate the reward system**, which in turn suppresses executive brain functions. Underactivity and a loss of control in the regions of the brain that are involved in movement or action activities is **accompanied by overactivity** in the regions of the brain that are involved in **cognitive functions** (e.g., excessive negative thoughts, brooding, self-doubt). In particular, the dysfunctionality of the reward system, which has not received sufficient scientific attention to date, poses a special challenge to the therapist. An important therapeutic goal is therefore the restoration of the reward system (i.e. the use of constructive strategies for short-term and long-term coping) and the removal of maladaptive behavior from the dominance of the reward system. It is required to develop a wide range of rewards-effective alternatives (activities, interests, coping strategies) that improve the psychological balance, enable constructive emotion regulation and overcome the feeling of “helplessness”.

Key words:

Psychoneurotherapy, depression-behavior, autonomous, reward systems, dysfunctional, “depression memory”, domination, (re)construction, reward-effective, alternatives

1. Introduction

A **major factor** in the cognitive-behavioral-biological approach to explanation covered here, is the **reward system** that creates the chemical messengers to achieve a "sense of well-being" and a "balancing" of stress-related negative feelings. A malfunction in this system can lead to a significant reduction of the "reward-effective" behavioral repertoire (i.e., reduction of stress, improvement of mood, maintenance of social contacts, enhanced well-being). When this system experiences significant dysfunctions, a person may be barely able to experience joy or interest. It is **not just narcotics** that are changing the reward system in a sustainable way. Scientific evidence on "problematic" gambling behavior shows that behavior is capable likewise of causing profound physiological changes in the **reward system** (Grüsser et al. 2005). Bachmann & Röhr provided similar explanations to explain various types of eating disorders (e.g., bulimia, anorexia; Bachmann & Röhr, 1983; Bachmann, 1992).

It is reasonable to examine if there is any **other behavior that entails a similar process**. After many years of experience treating people with **gambling disorder**, many with co-morbid depression (Ladouceur & Lachance, 2007), have led to the theoretical work to application the construct of "dysfunctionality of the reward system" to **depression**. Individuals affected by it show similar impairments in the ability to refrain from unwanted self-harming behavior and to achieve desired behavior. As a parallel to the "addiction memory", "**depression memory**" is now the **decisive neurobiological correlate**. Such an attempt is not intended to classify depressive disorders as dependencies. Instead, it is about **improving the methods** to eliminate the persistence of self-harming behaviors through **reward-effective alternatives** and **(re)establish the behavioral structure of constructive mood regulation in the reward system**. The treatment approach presented here does not cover all manifestations of the clinical picture of depression (e.g. serious external threats, effects on psychosocial functioning, general well-being, health and relapse prevention). In this context, reference is made to the conventional methods. For this reason, it is **necessary to include the existing relevant medical-psychological literature** in the treatment of depression. In this article, only one specific aspect of the disease, the interactions between psychological and neural processes, is considered in more depth.

The basic assumptions of the approach that is presented in this article are as follows:

- In the initial phase of disease development, the person frequently utilizes **copng strategies** (e.g., avoidance) that **lead to a strong but short-lived stress reduction**. The positive influence of the coping strategy on affect regulation often disappears within a short period of time.
- During the same phase of disease development, the individual fails to **successfully cope with the causes** of the psychologically stressful situation.
- There is a high probability that the **initial situation will worsen** due to the long-term negative consequences of the chosen strategies.
- Through the frequent and repetitive use of progressively maladaptive strategies, **conditioning processes** cause the (neurobiological) reward system to establish a persistent **self-damaging memory ("depression memory")**.

Böning & Grüsser-Sinopoli (2008) made the following observations about gambling addiction: it can be assumed that any reward is reinforcing to the brain, regardless of whether the **reinforcer** is a **pharmacological substance** that directly affects neurotransmitters (e.g., the dopaminergic reward system) or a **behavior pattern that is indirectly established by conditioning (which entails environmental stimuli)**. The **automation of dysfunctional behavior** should be understood only **within the context of neurobiological processes**.

Kuhl (2001) has observed that there is a **deformation in the reward system** that may be associated with **severe depression (ICD-10)**¹. According to him, unprocessed fears and external circumstances could give the impulse to trigger a conditional, almost autonomous reaction of the reward system in order to remain passive in the brain function of the executive. As a result, one may be unable to move and perform the necessary activities that are required to sustain a structured daily routine. According to Kuhl, this process is accompanied by excessive activity **in the areas of the brain that are responsible for legislative cognitions** (i.e., thinking and volition function). This combination leads to a paradoxical predicament: intense preoccupation with one's own goals and an inability to translate them into action.

The **conditioning processes that are involved in depression** are characterized by the following: when a person faces a stressful situation that is difficult to handle, he or she will respond by avoiding action activities² / movements (passivity in behavior). It can be expected that avoiding action in response to a stressful situation can ultimately lead to considerable but short-lived emotional relief.

According to the explanatory approach of the operant conditioning theory, the alleviation of a negative emotional state / improvement of well-being and the associated generalization of stimuli can lead to an increased probability to use this avoidance strategy to manage stressful situations.

Another postulate is, that a **progressive operant conditioning process** (which entails both positive and negative reinforcement) **lead to a bio-neurological structural change of the reward system**. Here, it leads to a persistent "**depression memory**", which is a constituent of autobiographical memory. The stress-reducing strategies used are the later behavioral symptoms (avoidance of movement, action activity) of depression (Beck et al., 2010). Although they may initially experience affective relief and stress-reduction, their coping strategies **do not address the stressor**. Instead, frequent use of such coping strategies will exacerbate depressive symptoms because the **long-term negative consequences** of such coping strategies are not considered and **worsen the initial stress situation**. This additionally increases the likelihood of dealing with stress by applying the chosen strategies such as avoidance.

The theoretical considerations have no end in themselves. Therapeutically implications suggest that it is important **to revive or rebuild constructive coping strategies** that can be used to manage stress and enhance well-being; this in turn will **address the dysfunctions that characterize the reward systems of depressed individuals**. This therapeutic approach, which aims to achieve structural changes in the reward system, poses special challenges to the practitioner. In order to lead a balanced and satisfying life, one should seek to adopt **behavioral changes that are incompatible with the course of the disease**.

Irrational and unfavorable cognitions contribute significantly to the onset and perpetuation of depression. However, they do not play a key role in the maintenance of **an advanced stage of the disease**. It is plausible that, in psychotherapy, (see Kuhl, 2001) a behavioral structure must be added to the "cognitive restructuring." In order to encourage a person to engage in activities, "action components" should be included in the treatment plan. Indeed, it may be necessary to temporarily situate them in the focus of therapy. In this manner, **overactivity in the cognitive regions** of the brain (i.e., legislative cognitions) can be **decreased**.

Grawe (2004, p. 18) has underscored the importance of **the neurobiological correlates of psychotherapy in the following manner**: if all psychic processes are based on neuronal processes,

¹ More information about the presentation of depression is presented in the internationally recognized diagnostic criteria ICD-10 (WHO, 2004). Among others: During mild, moderate, or severe depressive episodes, the patient suffers from a low mood, reduced levels of energy, and decreased activity levels. The capacity for enjoyment, interest, and concentration is reduced, and they experience high levels of fatigue even when minimum effort is expended. Sleep is usually disturbed, and appetite is diminished. Self-esteem and self-confidence are almost always poor; even in mild depression, feelings of guilt or worthlessness are often present. Their low mood does not vary substantially, and it is unresponsive to circumstances and may be accompanied by the so-called "somatic" symptoms (e.g., a loss of interest in pleasurable activities, decreased quantities of sleep, depressive symptoms that are worse in the mornings, marked psychomotor retardation, agitation, loss of appetite, weight loss, and a loss of libido). Depending upon the number and severity of the symptoms, a depressive episode may be classified as mild, moderate, or severe.

² Action activity versus cognitive activity

then altered mental processes underlie altered neuronal processes. We can prove that psychic processes can be effectively and permanently changed by psychotherapy. As a result, psychotherapy can permanently change neuronal processes and structures. Psychotherapy, **when it works, works by changing the brain**. If it does not change the brain, it is not effective either. The results of studies that have examined the plasticity of brain structures support the notion that the inclusion of causative physiological factors (i.e., structural changes in the reward system) significantly impacts the effectiveness of therapy.

A majority of behavioral disorders appears to be attributable to a failure to adequately manage stressful crisis situations. Grawe (2004, p. 159) underscored the important role that stress plays in the development of depression and posttraumatic stress disorder (PTSD) in the following manner: "Until recently, it has been fairly certain that the damage to the hippocampus in PTSD patients as in depressions is due to a temporary or longer lasting high cortisol level." When stressful situations result in exhaustion and impaired perception, the response repertoire is likely to be limited. Consequently, it may be difficult to address the causative factors and / or choose strenuous strategies that can help relieve negative emotions. In addition, it is important to consider the range of learned behaviors that an individual can use to deal with psychologically stressful situations; further, **unresolved traumas lead to additional increases in the level of stress**. Stressful situations (e.g., harassment on workplace) can be triggered by multiple factors.

The question is, who or what causes the psychic stress, are these factors recognizable for the person concerned? An inability to identify the adequate stressors may increase their feelings of "helplessness" (i.e., "Nothing I do can help me in this situation").

The challenges that are involved in creating a desirable psychological change are indubitably affected by the "quality" of the physiological correlates. The **level of difficulty** is likely to increase when the predominantly autonomous, **less influenceable brain structures of the reward system**, are involved. It has also been discussed that cognitive schemas are involved at every stage of the disease (i.e., from emergence to maintenance); but from some degree of depressive behavior symptoms, they do not have the primary share of maintenance.

2. The emergence and maintenance of depressive behavior symptoms – using the example of harassment in the workplace

2.1 The conditions of emergence

In Figures 1 and 3, ³the operant conditioning process that underlies the development of depressive behavior symptoms, including the restructuring of the reward system, is presented (see first Fig. 1). In a stressful situation (**S**; e.g., harassment), a person **reacts by avoiding action activity and movement (R)**. This leads to a considerable but short-lived relief from negative emotions (immediate consequence: positive [C+] and negative reinforcement [C-]). Frequent use of this strategy leads to negative consequences (Fig. 1: fifth column; downward-facing arrows) that can exacerbate the initial negative emotional state of an individual. In turn, the additional burden increases the level of the resultant dysfunctional behavior by further inhibiting executive functions and increasing legislative cognitive activities (**O**; intense thinking / brooding, self-doubt). The increased avoidance of movement / action activities results in the restructuring of the reward system; consequently, the respective coping strategies occupy a dominant position.

³ Behavior analysis that is based on the S-O-R-K-C: S-model describes the situation or the stimulus: Which personal or environmental conditions trigger the behavior? O = organism; it includes one's biological history and learning repertoire. R = reaction to the stimulus after it is processed by the organism. K = the regularity of the contingent relationship by which C follows R. C = the consequence (positive or negative) that determines whether the probability of occurrence of a behavior increases or decreases.

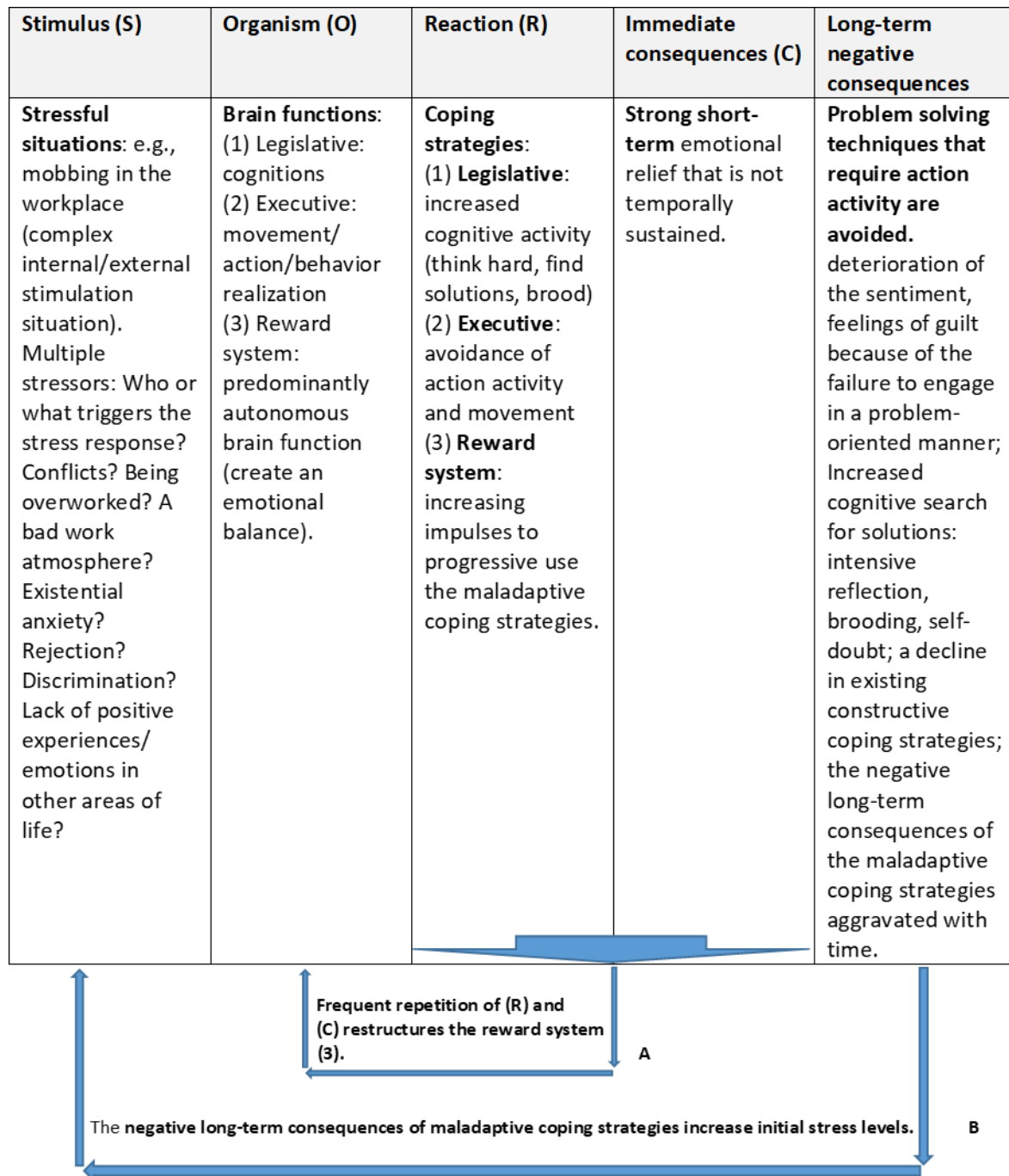


Fig. 1: Operant conditioning processes (i.e., positive and negative reinforcement; Kanfer et al., 2000) lead to an increased use of maladaptive coping strategies and neurobiological changes in the brain areas (O) that are responsible for legislative and executive functions and, in particular, the reward system (see the upward-facing arrow, "A"). In the long term (see bottom arrows B), the stress level (S) of the individual increases.

Hüther (2012) notes from a neurobiological point of view that the development of monistic behavioral patterns that adversely affect the self makes the **mood enhancement toolset** very one-sided. The structure of the "determination of neural connection patterns" is the greater, the more often certain strategies were used in dealing with negative feelings and subjectively evaluated as particularly successful.

Under the conditions that the stress situation has not been resolved or even exacerbated, the short duration of the positive emotional state often leads longer-term to an increase in the negative mood.

The need for the quick-reward effect is repetitively generated, alternatives are not in sight and the person sticks to it. In this manner, a vicious circle (circulus vitiosus; Fig. 2) is established. The short-term relief is followed by increased negative long-term consequences while lack of problem-solving, these strategies exacerbate the negative emotional state continuous.

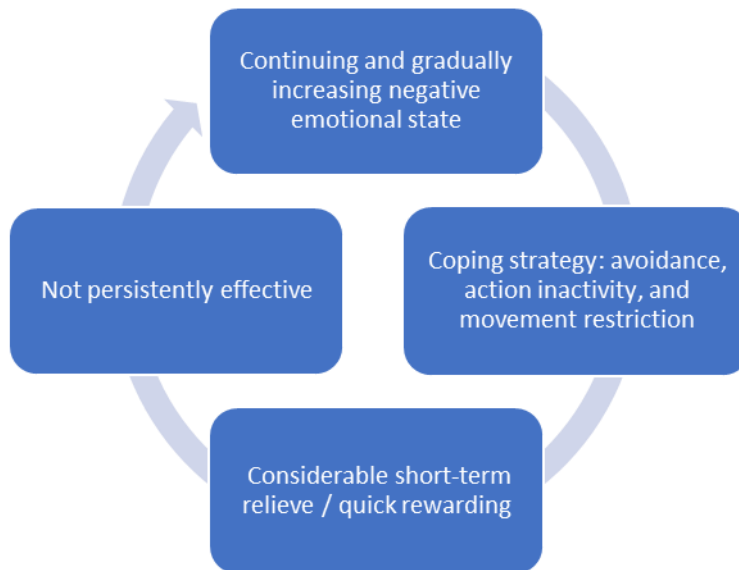


Fig. 2: *Circulus vitiosus*: a negative emotional state leads to an increased use of coping strategies that offer immediate considerable, but short-lived emotional relief, which in turn exacerbates the negative emotional state.

Apparently, the brain does not distinguish between constructive (i.e., a long-term perspective) and harmful (predominantly) autonomic behaviors. As this conditioning process progresses, alternative coping strategies have continued to decline and it is difficult to do anything that benefits later. More and more doubts exist to coping activities with greater physical-, mental effort, more time expansion to do something, that can improve the situation in the long run.

2.2 Maintaining factors

Figure 3 illustrates how a depression memory (O) evolves through the ongoing conditioning process. Previously neutral external or internal stimuli (S; e.g., the emotional consequences of harassment such as negative cognitions and emotional states) are associated with the maladaptive coping strategies. In addition to the fact that the (multifactorial) stress situation (S) may be difficult to identify for the individual, the **great potential of generalized stimuli** can **almost reflexively trigger** the behavioral symptoms of depression (R, avoidance strategies) and the associated bad mood. A clearly formulated behavioral intention (Böning & Grüsser-Sinopoli, 2009) does not have to exist (e.g., be passive, stay in bed).

The **inability to identify** the factor that triggers stress may **reinforce feelings of helplessness**. Difficulties in coping with life events lead to an increase in emotional burden. This can be the combined effect of damaging psychological, physiological, social, and economic consequences.

The development of the dysfunctional behavior can be summarized as follows:

- In a stressful situation, the biochemical balance that is required for **psychic stabilization** is achieved by using **coping strategies** that lead to **immediate but short-lived emotional relief** (avoidance, and restriction of movement and action).

S	O	R
<p>Psychological stress is exacerbated by:</p> <ul style="list-style-type: none"> • The (multifactorial causes of the) unresolved harassment on workplace. • Stimulus generalization; previously neutral external and internal stimuli trigger depressive behaviors (e.g., the emotional consequences of harassment, banal situational characteristics, stressful thoughts, other stressors, general malaise, feeling hurt, a deficit of positive experiences or "feel good chemistry"). • Lacking the ability to meet the demands of one's life. 	<p>The chosen coping strategies have occupied a dominant position in the reward system:</p> <ul style="list-style-type: none"> • The consequence of restructuring the reward system is the emergence of a "depression memory," which reacts to the conditioned stimuli almost reflexively. • Underactive executive functions (movement, action activity). • Overactive legislative cognitive functions (worrying a lot, thinking about problem-solving's, brooding). 	<p>The behavioral symptoms of depression/loss of control in executive functions:</p> <ul style="list-style-type: none"> • A predominantly automatic avoidance of action activity, movement, and behavior realization.

Fig. 3: In the advanced conditioning process, a depression memory is created when maladaptive behaviors trigger predominantly automatic responses in a phased or chronic manner and causes underactivity in the brain regions that are responsible for executive functions (e.g., avoidance of action activities, movements, behavior realization) and overactivity in the brain regions that are responsible for legislative cognitive (e.g., intense thinking, brooding, problem-solving) functions.

- Basic **problem-solving** requirements are **omitted**.
- In the **rewarding neural substrate** of the brain (the mesolimbic reward / motivation system), messenger substances (e.g., dopamine) are secreted.
- In a **comparable situation** (stimulus constellation), a person remembers the reward effect (i.e., significant short-term improvement in one's emotional state) and relies on the use of the same coping strategy.
- Frequent repetition gradually **automates the reinforced behavior** (i.e., avoidance of action activity, movement, and behavior realization), that occupies an dominate position within the hierarchy of the reward system.
- The **negative long-term consequences** of maladaptive strategies **worsen the initial emotional state of the individual** and in turn reinforce the use of the above strategies.
- **Adequate stress management** strategies are **neglected** and **take a back seat**.
- A prolonged conditioning process leads to **structural changes in the reward system** and to the development of a **persistent (neurobiological) depression memory**. In the brain there is an overactivity in the area of thinking and "volition-function" (legislative) and sub activity in (executive) movement, activity and action control.
- The maladaptive coping **strategies** (i.e., the behavioral symptoms of depression) **occupy a dominant position in the reward system**, develop an "own dynamic" and they can be **triggered almost automatically by multiple stimulus constellations** (stimulus generalization). This is associate with low mood, lack of positive experience and "feel good chemistry".

The last is an indication of the problem that "constructive" behavior changes are imaginable, but because of loss of control in "executive brain functions," there are serious difficulties to translate into concrete actions. The symptoms of the disease may be **additionally triggered by (previously neutral) stimuli**, which the **person may not associate with harassment**.

The dysfunctional **coping strategies** themselves **become a major problem**. Their short-term positive effects (i.e., the result of **passivity in executive behaviors**) decline sharply (i.e., they yield increasingly negative outcomes), and consequently, there are no other alternatives that are available to the individual. The deeper brain regions of the reward system, which are responsible for reflexes and automatic responses, exercise greater parts of behavioral control (i.e., remain behavioral passive). The influence of reason and logic is greatly reduced, and the patient often becomes a "helpless observer" of self-harming behaviors (see Fig. 4).

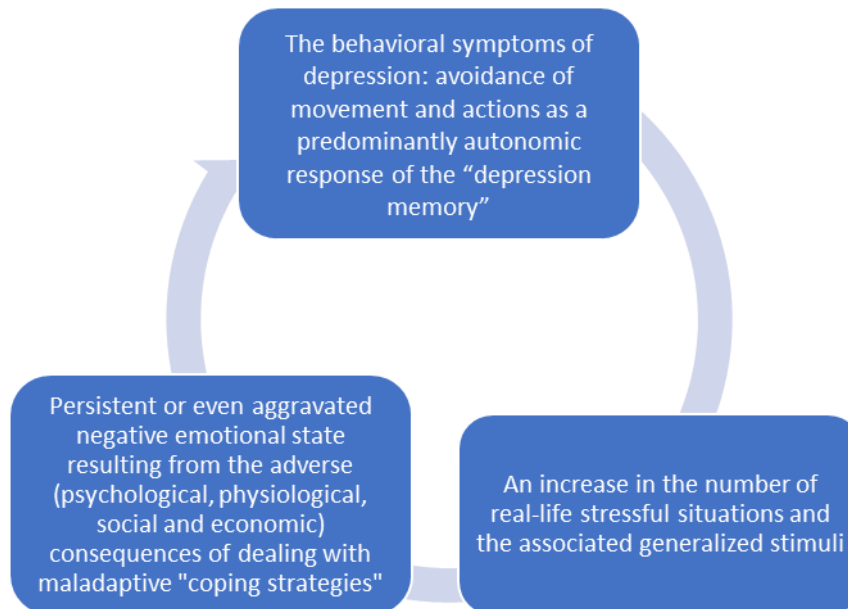


Fig. 4: Circulus vitiosus: depression as a conditioned and autonomic reaction.

The question will hardly be answered within which time periods and contingencies (K: frequency of occurrence C+, C- / after the reaction) the operant conditioning process leads to the creation of a depression memory. When people are asked about the situation that triggered their depressive episode, they often have no answer. They often experience the deterioration of their mood as a "trapdoor-like" process. However, when they engage in longer reflective discussions that guarantee a higher degree of relaxation and self-exploration, they rather **recognize** the causes (**triggering stimuli**) of their depressive moods. Insights into the underlying causes of one's onerous condition can alleviate **their sense of helplessness** and provide strategies that help them cope constructively with these situations as well as develop alternative coping strategies. The low levels of personal control that depressed individuals have over their behavioral possibilities may lead to feelings of frustration. On the one hand, they may experience thoughts about their inability to handle simple tasks and cope with life's demands. However, this situation can be ambivalent because they may also hope to make new attempts to achieve their goals and translate their intentions into action in the near or distant future. Unfortunately, they do not engage in sufficient concrete / realistic planning and realization of behavioral goals (e.g., taking the smallest achievable step); therefore, their good intentions do not lead to desired behavioral changes.

Depression memory and risk of relapse persist: experience in the field of addiction and treatment of depressive patients suggests that the problematic memory structures persist, although they no longer play a dominant role after the establishment of alternative behavior. A certain alertness is required because the depression memory with appropriate stimulation can continue to trigger an autonomous depressive reaction and thus a relapse.

3. Treatment

3.1 Depression as an expression of a **predominantly reactive disorder**

Under this classification, depressive symptoms are considered to be a **reaction to an identifiable stress-inducing event**.

At this stage of the disease no fundamental change in the reward system has taken place. Therefore, the focus of the treatment must be on the readily identifiable (personal and / or environmental) stressors that cause negative emotions. In principle, the questions arise as to whether direct influence on the causative **external condition** and / or an expansion of **one's own competences** (cognitive, behavioral-related) is necessary to cope with the stress situation. In particular, stress-inducing situations such as harassment on workplace, the loss of social relationships and loved ones, existential insecurity, a sudden end to positive experiences and habits, and serious health problems can cause a significantly depressed mood.

A very active sportsperson who experienced an injury experienced a significant emotional need to restore his former mental balance. He commented, "I always got a lot of sports and physical activity!" He has received intensive medical help and training, and he is eager to regain his fitness as soon as possible. It may be helpful to him to **expand his interests and activities**, and consequently widen his range of feel-good activities.

A careful state analysis should clarify where stress causes are and how the situation can be changed positively. With regard to the stages of depression in which there are no signs of an autonomic reaction, detailed therapeutic explanations must be omitted; instead, one must **refer to the existing literature**. Nevertheless, the (re)construction of a diverse "interest and activity spectrum" and the problem of the "feasibility of desired behavioral changes," which are discussed in the following sections, have **preventive functions** because they can attenuate the risk of relapse.

3.2 Depression as a **predominantly autonomous reward system-controlled reaction**

In accordance with the assumption that depressive behavior symptoms are predominantly autonomic reactions of the reward system, the elements of the therapeutic concepts that pertain to problematic gambling behavior (Bachmann, 2004; Grüsser & Albrecht-Sinopoli, 2008; Bachmann & El-Akhras, 2014; Bachmann, 2017) are used in the following discussion. The arrows presented in Fig. 5 illustrate the postulated disease course and treatment process.

The original "coping strategies" develop imperceptibly to the burden. Despite their best intentions and intense cognitive processes (i.e., overactive cognitive regions of the brain), **they may fail to engage in the behavioral activities that are necessary for the conduct of daily life**. Indeed, due to the potentially multifactorial causes of stress as well as the conditioned (generalized) stimulation of previously neutral stimuli, the plausible causes of a negative emotional state and the extent to which they influence mood may often be imperceptible.

To interrupting the vicious circle and removing the loss of control over the executive functions, if the overall situation allows it and there are no serious external threats, the treatment is performed in an order that is more the opposite of the course of the disease. That is, the most recent symptoms, the behavioral symptoms of depression (avoiding exercise, action activity), are the first to be included in the therapy. This in order to **achieve a gradual (re)construction of a functional reward system**.

The Course of the disease

The stressful situation:
persistent negative affect,
personal and/or environmental
causative factors.

Coping strategy:
use of a **coping strategy** that
provides **strong and immediate**
but short-lived emotional
relief: avoidance of movement,
action activity/behavioral
realization. Stressors are not
eliminated; instead, they
worsen.
Due to frequent repetition,
operant conditioning processes
result in structural changes in
the reward system and
ultimately the development of a
depression memory.



Loss of control over executive
functions:
an almost-autonomous
reaction of the depression
memory to stressful situations
and its association with (inner
and outer) generalized stimuli:
depressive behaviors (e.g.,
avoidance of action activities,
movement, behavior
realization) are largely triggered
in a **reflexive manner**;
depressive behaviors takes a
dominant position in the
reward system and develops its
"own dynamic" (symbolized by
the diagonally positioned
arrow). Depressive mood.
Strong lack of positive
experience and "feel good"
chemistry.

**The therapeutic process: rather going backward, in a manner that is converse to the
disease course**

Analysis and treatment of the
original stress-inducing
situation - personal and/or
environmental causes: analysis
of the stress-inducing
conditions and the
psychological coping strategy
and reward potential.

Reconstruction of the reward
system - building up a variety of
action activities (movement)
and interests:
A) Adopt constructive strategies
that provide immediate
emotional relief.
B) Develop effective coping
strategies that provide long-
term emotional relief from
negative emotions and enhance
well-being; anchor these
alternative behaviors (A/B) as
strong habits.
(Re)construct a wide range of
interests and activities (IAS)
C) Strengthen one's self-
confidence to realize goals;
enhance self-esteem; work
toward a balanced lifestyle.

Encourage the utilization of a
comprehensive treatment plan,
and gain insight into the disease
process:
What triggers crises? What are
the conditions/stimuli that
trigger a depressive response?
Begin to develop constructive
alternative behaviors to
interrupting the own-dynamic
of the behavioral disorder (e.g.,
daily structure/goal
transformation by taking small
steps).
Questioning unfavorable
cognitions.

Fig. 5: The relationships between the treatment process and disease course: Contrasting pathways.

The focus of the therapeutic intervention is initially on the elimination of the dominance of depressive symptoms (i.e., avoidance of movement, action activity) in the reward system and on the interruption of the automatic response ("own dynamic") of the depression memory. It can be a difficult process to find the **most beneficial (reward-effective) alternative interests and activities** and **firmly anchor them in the reward system**. In this regard, the advances in the activation of alternative rewarding behaviors create a more optimal condition to work on the causes of the disease.

A brief fragmentary compilation of the therapeutic approach:

- Condition analysis: make the disease process transparent to the client.
- Relate action and cognition in a meaningful way: communicate about thoughts and feelings:
 - Facilitate **self-exploration** as a part of the therapeutic speech, **question unfavorable cognitions**, and **reorganize thoughts**.
 - Use a personal "lively" discourse as a meaningful "action reactivation" to improve the mood and reduce psychic stress.
- Simultaneously, **define other achievable action goals**.
- Initiate actions, approximate goals by taking **small steps**, and **maintain** the corresponding behaviors.
- Adopt **constructive coping strategies** and reward-effective alternative interests and activities **by repeatedly practicing them until they develop into stable habits**.
- Do not end social and therapeutic assistance before **decisive steps** are taken to achieve behavioral goals and establish (short-term and long-term) constructive coping strategies in the reward system.
- **Reflect on goal realization** and the development of one's abilities, so that one's experiences (feelings and thoughts) are adequately communicated.
- Encourage and **reflect on positive experiences** and the development of humor or black humor (e.g., in the case of failed goals).
- Expand the range of **depression-incompatible interests and activities** that one engages in.
- **Reexamine setbacks: What are the conditions that triggered their depressive behavior and mood symptoms?** Which action-based problem-solving strategies can be used in the future?
- Address **the original cause** (initial situation) of the disease (e.g., stress-inducing personal and environmental conditions); review objectives, assessments, available resources, attend to the social and psychobiological spectrum of the person (p) and their environmental conditions (e).

It is assumed that the successful realization of reward-effective behavioral alternatives is the best prerequisite for positive thinking and an improved emotional state. This in the sense of acting / moving and expand the range of interests and activities.

The mutual influenceability of behavior, cognitions, emotions and physical condition is basically not bound to any sequence or hierarchy; therefore, it is theoretically possible for therapeutic interventions to target every influencing factor (cf. Gross and Thompson, 2007).

Previous experiences with own "helplessness", not to be able to influence situations and the emotional state sufficiently positive, lead to unfavorable (whether they are unrealistic, may be an open question) "cognitive schemes". For example, to give up faster and have less self-confidence to start something new.

At each stage of disease development, unfavorable cognitions may be involved and contribute to persistence of non-action behaviors. However, the cognitive approach has not paid sufficient attention to the fact that the **physiological "resistances"** from **structural changes in the autonomous reward system** play a decisive **role in maintaining depressive behavior and mood**. In cognitive therapy, negative thoughts are questioned. However, additional assistance in dealing with what may initially be the smallest steps, a gradual expansion of actional and movement potential and experiences of success in these doing, may be superior to a "pure disputation".

Excursus: unfavorable ("unrealistic") cognitions

The cognitive model that was proposed by Beck et al. (2010) explains the psychic substrates of depression using three components:

- 1) The cognitive triad (i.e., a negative view of oneself, the future, and the environment)
- 2) The schemas (i.e., to neglect all experiences)
- 3) The cognitive errors that are maintained despite disconfirmatory objective evidence of the positive aspects of one's life (i.e., erroneous information processing).

One way to understand depressive disorders is through the use of the two types of reality organization: a primitive one and a mature one. Beck et al. (2010, p. 45) have made the following observation: Obviously, depressive people tend to structure their experiences in a relatively primitive way. They tend to judge events that happen to them in their lives undifferentiated and globally. The cognitions that are used to control their consciousness are rather extreme, negative, categorical, absolute, and judgmental. The corresponding emotional reaction is therefore rather negative and extreme. In contrast to this primitive way of thinking, in mature thinking life situations are automatically processed in terms of many dimensions and qualities, rather than a single category.

Valuations such as 'primitive' or 'mature' are dispensable if the biological factor (dominance of dysfunctional structures in the reward system) is included. According to the findings of studies that have been conducted by De Jong et al. (1980, 1985) and Hautzinger et al. (1989, Hautzinger, 2010), intervention strategies that rely purely on "cognitive" elements do not adequately treat depression. For example, patients who receive a **combination treatment (cognitive and behavioral therapy)** as well as the patients who belonged to the waitlist control group demonstrated better outcomes than those who received a treatment that was based solely on cognitive therapies. In addition to cognitive restructuring, the combination treatment entailed activity building and social competence training. Therapeutic planning must rely on existing resources (Grawe & Grawe-Gerber, 1999) to identify and include **constructive short-term and long-term coping** and **feel-good strategies** that can positively influence one's emotional state and improve their general living situation. It is unlikely that all the coping strategies that yield short-lived beneficial outcomes have the potential to be destructive. This question must be addressed in future empirical studies (see below). Depression and addiction entail the absence of many activities and behaviors. Kuhl (2001) has noted that severe depression is primarily characterized not by the experience of negative emotions but by a **lack of positive emotions**.

The **sufficient training / practice** of disease-incompatible alternatives, initiation of movement and action activity, and the associated positive experiences provide the opportunity to maintain an inner psychological balance, cope with problem situations, and enhance overall well-being. Other **reward-effective behaviors** that may **have previously existed (and are currently reactivated)** and **newly developed alternatives** have to **displace the dysfunctional behaviors that occupy the dominant position** in the reward system (see Fig. 6).

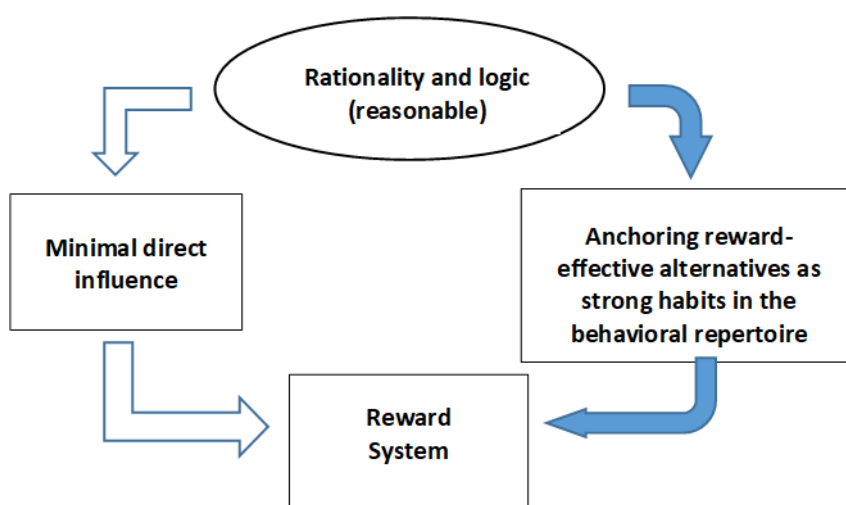


Fig. 6: The establishment of reward-effective alternatives to restructure the deeper brain regions of the reward system: an illustration of the underlying mechanism.

It is plausible **that frequent repetition and regularity are prerequisites for superseding the dominant dysfunctional behaviors** and firmly anchoring the alternatives in the reward system. The overcoming of depression and dependencies involves the ability to be interested in, engage in many other aspects of life, have fun on it and to translate **cognitive intent into purposeful actions**. Individual inclinations and personal needs must be considered, when one attempts to discover and develop new reward-effective behaviors.

Hautzinger & Wolf (2012) investigated the effectiveness of sports on mental (self-efficacy, distraction from negative thoughts), social (social support), and biological factors (monoamine, cortisol levels, neurogenesis, immunological processes) within the context of depression. The results of this empirical study suggested that sports have a positive effect on the aforementioned factors. However, **the strength of the effect and the factors that account for this effect** (e.g., motivation) **have not yet been sufficiently examined**. Moderate training appears to be more effective than extremely intense training. The effect of sports on relapse prevention has not yet been investigated. Grimm & Krämer (2014) found that depressed individuals could be divided into four groups (clusters) based on the scores that they obtained on self-report measures of motivation, intentions, and attitudes toward sports: no intention to engage in sports (1), moderate levels of intention to engage in sports (2), a strong intention to engage in sports that have not been translated into actions (3), strong intentions to engage in sports that have been followed up with corresponding actions (4). According to Fuchs & Schlicht (2012), **the positive effects of sports on both general psychological well-being and on depression (Mead et al., 2009; Rethorst, 2009) have been adequately demonstrated in empirical investigations**. In addition, the outcomes of cognitive treatments were significantly better when they were combined with physical exercises **or other activities (e.g., social skills training; De Jong et al., 1980; Cuijpers et al., 2010)**.

Given that disease-related actions restrict movement and action activities, adequate attention must be paid to **physical fitness** so that anticipated stressors can be adequately managed (e.g., work stress that one experiences after the termination of therapy). Therefore, it is important to counteract the dangers of overtaxing (e.g., "I felt completely exhausted after the first few days of workplace"). More often than not, sufferers may mistakenly attribute unexpected states of fatigue to psychological or motivational factors (e.g., "It was not the right decision after all") rather than to physical performance. At present, we are conducting empirical studies that examine the spectrum of interests / activities (IAS) and the feasibility of desired behaviors. Categories of the IAS are **e.g.**: school-professional perspectives, social contacts, movement activities / sports, debates, expression of feelings, exposure to bright light and fresh air, creativity, spirituality, music / singing.

3.3 The realization of therapeutic goals: reduce psychological and physiological resistors

A dysfunctional reward system contributes to the maintenance of behavioral disorders by delaying behavioral changes or rendering them unsuccessful. The role that this process plays in depression and other disorders may be grossly underestimated. Accordingly, **scientific evidence from the field of postponement could contribute significantly to the success of the corresponding treatments**.

Postponement may often be a reaction to the presence of psychological (e.g., failure, the absence of an affordable entry or the smallest achievable step) and physiological resistances (i.e., the dominance of certain behaviors in the reward system). In this regard, Steel (2011) has underscored the role of a latent conflict between the prefrontal cortex (which is responsible for volitional decision-making) and the limbic system (which is the seat of pleasure, fear, immediate gratification, and excitement). Therefore, a behavioral disorder indicates that the limbic system has become dominant either temporarily or permanently.

The dominance of maladaptive behaviors in the reward system attenuates self-esteem and impedes the behavioral changes that are necessary to overcome psychic impairments and adequately improve one's living situation (see Fig. 7).

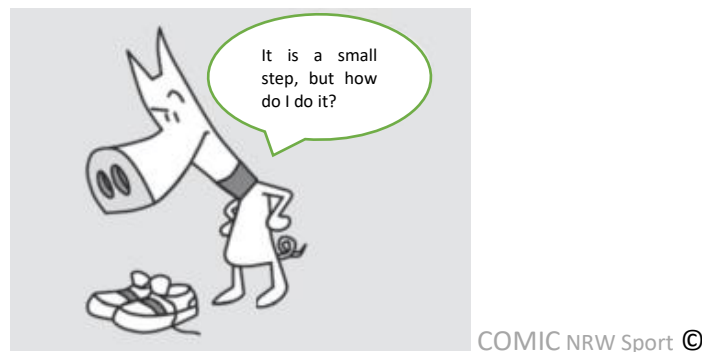


Fig. 7: Overcoming psychological and physiological resistance.

Postponement test results show that it is not sufficient to just work on the attitudes towards the set goals and expect this to lead to an automatic realization of the desired behavior. Instead, it should be supported to make first small behavior steps in goal direction and then gradually greater, more and more, towards the desired behavior change. The resulting feeling of having accomplished something, even marginally at first, leads to a change in attitude ("that's not so bad and is even fun") and increased self-confidence to realize the overall goal. As a result, successful actions facilitate positive thinking and self-esteem. On the other hand, when attitudinal changes precede action activities (e.g., "If I think long enough, the behavior will change") fewer positive results tend to follow. Therefore, goal achievement appears to entail a bottom-up rather than a top-down process (Rist et al., 2006). Accordingly, therapeutic efforts aim to **develop concrete plans, gradually approach the desired behavior, structure one's daily routine in a meaningful way, and create weekly plans that entail a sense of balance and relaxation on a daily basis**. In this regard, colorful events ("highlights") must be planned so that the routine of daily life does not paint a gray portrait of existence. A balanced lifestyle is the best guarantee against the risk of relapse. The best possible foresight on the expected level of stress and the available regulatory "balancing" potential is, on the one hand, the basis for managing the obligations, as well as creating a daily and weekly relaxation plan that includes a wide range of interesting activities. "

On a lovely summer day, a patient responded indignantly / ironically to an "inappropriate" question that was posed by the therapist. The last thing that she wanted to do was to go for a swim in the swimming pool.

The "reward potential" that a particularly valuable behavior confers on health and stability are often not immediately recognized; instead, they are apparent after a phase of learning and training, and / or after one's competencies have improved. Depending on the level of difficulty, **the frustrations that this process entails must be overcome** so that the desired positive effects of the new or reactivated behaviors on the emotional state are established gradually, effectively, and persistently. A sufficiently strong **establishment (anchoring) of a behavior in the reward system often require considerable endurance**. Therefore, to go this way, people with psychic disabilities need more social, psychotherapeutic and medical assistance. At this stage of the therapeutic process, there is often a lack of therapeutic interventions and sufficient support systems that can facilitate effective long-term behavioral changes. The psychic and physis resistance that one experiences will be gradually replaced by the rewards of the new alternatives; consequently, the desired behavior will be successfully established.

There are numerous non-performance-based factors that could motivate behavior (e.g., the joy of movement; positive experiences; activities that induce high levels of positive emotions and relaxation; sports and games); however, these factors have been neglected by researchers. An additional positive effect of **differentiation and diversity** is that individuals will **not go from one (behavior-) extreme to another**.

To verify our hypotheses, we compare in an empirical investigation several groups of individuals (addictions, behavior disorders, controls) of a monistic vs. diverse rewarding interest / activity spectrum and examine the correlations with variable such as life satisfaction and depression. Another question that requires further investigation pertains to the extent to which the psychophysiological approach that is presented in this article is applicable to the treatment of other behavioral disorders (e.g., eating disorders, obsessive-compulsive disorders). Furthermore, the goal is to **improve the treatment methodologies** that seek to facilitate behavior change and **address the dysfunctional reward system** so that depressed individuals can regain control over their executive brain functions.

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